

REMARKS

The Applicants have studied the Office Action dated July 1, 2004 and have made amendments to the claims to distinctly claim and particularly point out the subject matter which the Applicants regard as the invention. No new matter has been added. It is submitted that the application, as amended, is in condition for allowance. By virtue of this amendment, claims 1-26 are pending. Reconsideration and allowance of the pending claims in view of the above amendments and the following remarks is respectfully requested.

In the Office Action, the Examiner:

- (1) accepted the drawings for examination purposes;
- (2) noted the IDS is in compliance with the provisions of 37 CFR 1.97;
- (3) objected to specification because the related application serial numbers are missing;
- (4) rejected claims 1-26 under the judicially created doctrine of obvious-type double patenting;

(7-17) rejected claims 1-25 under 35 U.S.C. §102(e) as being anticipated by Kazar et al (U.S. Pub No. 2002/011022); and

(18-19) rejected claim 26 under 35 U.S.C. §102(e) as being anticipated by Lewis et al (U.S. Pub No. 2002/0083037).

(1-2) IDS and Drawings

The Applicants wish to thank Examiner Channavajjala for noting the IDS is in compliance with provisions of 37 CFR 1.97 and that the drawings are acceptable for examination purposes.

(3) Objection to the Specification

As noted above, the Examiner objected to the specification at page 1 because the cross-reference to related application serial numbers are missing. The paragraph of page 1 has been amended to properly supply the related application serial numbers. The Applicants respectfully submit that the Examiner's objection to the specification has

been overcome and should be withdrawn.

(5) Rejection under Obviousness-type Double Patenting

As noted above, the Examiner rejected claims 1-26 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-27 of co-pending Application No. 10/077,246, now U.S. Pub No. 2003/0158873, and claims 1-34 of co-pending Application No. 10/077,320 now US Pub. No 2003/0158862. The Applicants believe there is no double patenting with the present invention in view claims 1-27 of the co-pending Application No. 10/077,246, now U.S. Pub No. 2003/0158873, and claims 1-34 of co-pending Application No. 10/077,320 now US Pub. No 2003/0158862 because the present invention is patentably distinct, in order to quickly further prosecution, a terminal disclaimer is submitted herewith. Accordingly, with the submitted terminal disclaimer, the Examiner is respectfully requested to withdraw the rejection the judicially created doctrine of obviousness-type double patenting.

(6-17) Rejection Under 35 USC § 102(e) Kazar

As noted above, the Examiner rejected claims 1-25 under 35 U.S.C. §102(e) as being anticipated by Kazar et al (U.S. Pub No. 2002/0112022) (Hereinafter "Kazar"). The Examiner cites 35 U.S.C. § 102(e) and a proper rejection requires that a single reference teach (i.e., identically describe) each and every element of the rejected claims as being anticipated by Kazar.¹ The elements in the amended independent claims 1, 7, 13 and 19 related to invalid disk addresses, such as ditto addresses, are not taught or disclosed by Kazar. Accordingly, the present invention distinguishes over Kazar for at least this reason. The Applicants respectfully submit that the Examiner's rejection under 35 U.S.C. § 102(e) has been overcome.

Independent claims 1, 7, 13, 19, and 24 have been amended to more clearly distinguish

¹ See MPEP §2131 (Emphasis Added) "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the ... claim."

over Kazar. Preferred Embodiments of the present invention provide an Improved apparatus, computer-readable medium and method for providing file system snapshots with ditto addresses. The present invention utilizes inferred logical references, which are indicated by the use of "ditto" addresses in the inodes of the snapshot dataset, when a physical reference to the original datablock is not stored in the snapshot dataset. The use of logical references in the claimed invention overcomes problems with prior art in general, and Kazar in particular, where only physical references are discussed and used. Physical references, unlike logical references, are limited to specific hardware constraints such as disk size. The use of logical references by the claimed invention permits the re-mapping of storage locations to newly added disk space. The logical references that include ditto addresses of the present invention further obviate the requirement to store the physical disk address of each data block in the inodes of all of the system snapshots, as is required for prior art systems and explicitly taught in Kazar.

In order to more particularly point out this feature of inferred logical references to the original data blocks through the use of "ditto" addresses, language has been added to the independent claims, i.e., claims 1, 7, 13, 19, and 24 that is equivalent to the following limitations of amended independent claim 1:

generating a snapshot dataset for a source file in a file system, wherein the snapshot dataset contains substantially no data and no metadata;

copying into a first inode within the snapshot dataset, in response to only modifying metadata of the source file, at least a portion of metadata within a second inode corresponding to the source file; and storing, into the first inode, disk address values equal to a ditto address to indicate that the disk address is an invalid disk address.

The Applicants have similarly amended dependent claims which depend from these dependent claims, and have further amended the dependent claims to preserve proper antecedent bases. No new matter has been added.

Support for this amendment is found in the specification as originally filed at least at

pages 9, 10, and also in FIG. 7 and the associated description for FIG. 7 found in the specification at pages 20 through 25.

With regards to claims 1, 7, 13, and 19, the Examiner at page 5 of the office action cites Kazar as teaching the limitation of:

generating a snapshot dataset for a source file in a file system, wherein the snapshot dataset contains substantially no data and no metadata

The cited portion of Kazar teaches generating snapshots. (Kazar, paragraphs 82, 84 and FIG. 1). The Examiner states that "substantially empty," which has been amended in the present claims to read "contains substantially no data and no metadata," corresponds to a teaching of Kazar of: "propagating changes or update changes of a clone to remote sites by only sending the data blocks that have changed since the last replica was propagated[.]" (Paper 5, page 5, emphasis added). Applicants traverse the Examiner's assertion that Kazar teaches this limitation. The cited portions of Kazar refer to "comparing an existing replica with a new release of a replica. Kazar, paragraph 0084. Applicants assert that this implies that the "replicas" are fully populated copies of the datasets and are not empty, or contain no data and no metadata, in the context of the Kazar reference. Further, with regards to creating a snapshot, Applicants assert that Kazar teaches that "When a clone is created, each file's inode is copied, with the result that the copied inode points to the same data blocks as the original." Kazar, paragraph 0069. This passage clearly indicates that cloned datasets contain a complete set of inodes as soon as they are created. The present invention overcomes this requirement to create a new inode clone by "generating a snapshot dataset for a source file in a file system, wherein the snapshot dataset contains substantially no data and no metadata" as is claimed for these independent claims.

Applicants have amended these independent claims to more clearly specify snapshot dataset inode creation and the copying inode data into the snapshot dataset as follows:

copying into a first inode within the snapshot dataset, in response to only modifying metadata of the source file, at least a portion of metadata within a second inode corresponding to the source file; and storing, into the first inode, disk address values equal to a ditto address to indicate that the disk address is an invalid disk address.

Applicants assert that the elements of these limitation, which comprise not including any disk address values of data blocks corresponding to the source file, and storing disk address values equal to a "ditto" address, are not taught or suggested by the prior art of record. The cited portion of the Kazar reference states "a cloned inode is created simply by copying the original inode, and then setting the CTW bit on all the direct block pointers and indirect block pointers contained in the inode itself." Kasar paragraph 75. The cited portions of Kazar discuss vnode operations, which are operations on inodes, the creation of which is described by the preceding citation.

As described by the amended independent claims, at least a portion of the metadata within the inode corresponding to the source data, which is metadata in the inode referred to as the second inode, is copied into the inode of the snapshot, i.e., the first inode, in response to only modifying metadata of the source file. Applicants respectfully point out that this differs from the Examiner's understanding of shadow inodes. The first inode of the presently amended claims are not created when the file is opened, they are only populated, in the aspect of these amended independent claims, as metadata for the source file is modified.

Further, in the context of the independent claims, the present invention stores "ditto" values as disk address values in the inodes of the snapshot dataset, and not the physical address of the physical data blocks themselves. As defined by the claim language, a ditto address stored in an inode of the snapshot dataset indicates that the disk address stored in that inode is invalid. Such an invalid disk address value indicates that a "logical address" is to be determined. Determination of the logical address is detailed in the specification, as is described above in regards to FIGs. 7A and 7B and associated descriptions in the specification at pages 20 through 27. An advantage of the

present invention over the prior art, such as the system of Kazar, is that the present invention does not maintain multiple inodes, i.e., the active file system inode and the multiple snapshot dataset inodes, that each point to the same data block. This structure of the Kazar system is discussed in Kazar as: "When a clone is created, each file's inode is copied, with the result that the copied inode points to the same data blocks as the original." Kazar, paragraph 69. This aspect of the presently claimed invention advantageously simplifies tracking of data block relocation and other actions, such as deleting and modifying.

With regards to claims 2, 8, 14 and 20, which claims a further step similar to that discussed above with regards to the amended independent claims, but in which at least a portion of metadata is copied in response to appending data to the source file, Applicants assert that these amended claims distinguish over the cited prior art for at least the same reasons. Kazar simply teaches copying inodes and does not teach or discuss selectively copying data from a source file system inode to a clone or replica file system inode in response to a process, as is recited for these amended dependent claims. Further, the use of a "ditto" address or its equivalent in the newly created inode, which is defined in these amended claims as indicating "that the disk address is an invalid disk address" is further not taught or suggested in the prior art of record.

With regards to claims 4, 10, and 16, which are directed to accessing data in the snapshot dataset through the logical addressing scheme of the present invention. As amended, these claims, as represented by amended claim 4, recite:

accessing the first inode of the snapshot dataset corresponding to
the source file;
determining whether the first inode includes a valid disk address,
wherein if the first inode includes a valid disk address, then reading
a data block referenced by the disk address; and
wherein if the shadow inode contains the ditto address, then
retrieving the second inode of the source file and retrieving a data block
referenced by a disk address in the second inode of the source file.

These claimed steps of amended method claim 4 show that inodes of the snapshot

dataset are examined to determine if those inodes contain a valid disk address and if they contain a "ditto" address, the second inode, i.e., the inode of the active file system, is accessed to determine the disk address of the data block to be retrieved. Applicants assert this is totally inconsistent with the teachings of Kazar, which states that "the copied inode points to the same data blocks as the original." Kazar, paragraph 0069. A major advantage of the present invention is that only one inode ever points to a particular data block and the housekeeping associated with maintaining multiple inodes that all point to the same data block is obviated. Such housekeeping is explained at length in Kazar, such that described by "additional information is required in order to determine when a disk block can actually be freed. When one releases a disk block, one must ensure that all references to it are gone before one can free it." Kazar, paragraph 0070 (emphasis added). Such concerns are totally absent from the claimed aspects of the present invention since only one inode points to a particular data block, and "ditto" addresses are used to indicate that the real disk address of a data block must be found elsewhere, as is recited for amended claims 4, 10, and 16.

With regards to claims 6, 12, and 18, these claims recite similar features and benefits, and similarly distinguish over the cited prior art, as claims 4, 10, and 16. Reference is made to the remarks above for claims 4, 10 and 16 in distinguishing claims 6, 12, and 18 from the cited prior art.

With regards to claims 22 and 23, Applicants have amended dependent claims 22 and 23 to more clearly specify the characteristics of the ditto address stored in the first inode, which is an inode stored in the snapshot dataset. The ditto address is specified in amended claims 22 and 23 to indicate an invalid disk address. As discussed above, Kazar and the other prior art of record is silent as to an inode that has an invalid disk address. As noted above, Kazar only discusses storing data block addresses in the inodes of each dataset clone, in stark contrast to the invention claimed by amended claims 22 and 23.

With regards to claims 24 and 25, Applicants have amended claims 24 and 25 to more clearly specify the characteristics of the snapshots of the present invention, which

include "ditto" addresses, which are discussed above as an indication of an invalid disk address. As discussed above, Kazar and the cited prior art are silent on using invalid disk addresses in inodes of snapshots or clone datasets, and therefore cannot include a teaching of the invention claimed by amended claims 24 and 25.

Additionally, Applicants note that amended dependent claims 2-6, 8-12, 14-18 and 20-25 depend from amended independent claims 1, 7, 13 and 19, respectively. As discussed above, amended independent claims 1, 7, 13 and 18 to more clearly distinguish over the cited prior art. Since dependent claims include all of the limitations of the independent claims from which they depend, Applicants further assert that amended dependent claims 2-6, 8-12, 14-18 and 20-25 also distinguish over the cited prior art as well. Therefore, Applicants respectfully assert that the Examiner's rejection under 35 U.S.C. §102(e) over Kazar should be withdrawn.

(6-13) Rejection Under 35 USC § 102(e) Lewis

As noted above, the Examiner rejected claim 26 under 35 U.S.C. §102(e) as being anticipated by Lewis et al (U.S. Pub No. 2002/0083037) (Hereinafter "Lewis"). Independent claim 26 has been amended to more clearly distinguish over Lewis. With regards to claim 26, Applicants have amended independent claim 26 to more clearly specify the restoration processing aspect of the present invention. Independent claim 26 has been amended to specify that "if there is a ditto disk address in the first snapshot, wherein the ditto address indicates an invalid disk address, copying to the file system the inode or data block of the most recent snapshot that corresponds to an inode with the ditto disk address and that contains a valid disk address.

To begin, the Lewis reference is directed to a method and apparatus for creating a snapshot of a file system. Although the system of Lewis uses a copy-on-write mechanism, Lewis is silent as to any form of "logical addressing," such as through the use of "ditto" addresses, as is claimed for the present invention.

Applicants have amended independent claim 26 to more clearly specify the processing performed in restoring a snapshot to a file system, and in particular have clarified the

processing performed upon encountering a "ditto" address in the snapshot being restored. A "ditto" address is specified in amended claim 26 as indicating an invalid disk address. Applicants assert that Lewis, and the other prior art of record, does not teach or suggest using invalid disk addresses within inodes in order to implement a logical address, which is used by the claimed aspects of the present invention and as is described above. Applicants therefore respectfully assert that amended claim 26 distinguishes over the Lewis reference and the other prior art of record and that the rejection of this claim under 35 U.S.C. §102(e) should be withdrawn.

CONCLUSION

The remaining cited references have been reviewed and are not believed to effect the patentability of the claims as amended.

In this Response, Applicants have amended certain claims. In light of the Office Action, Applicants believe these amendments serve a useful clarification purpose, and are desirable for clarification purposes, independent of patentability. Accordingly, Applicants respectfully submit that the claim amendments do not limit the range of any permissible equivalents.

Applicants acknowledge the continuing duty of candor and good faith to disclosure of information known to be material to the examination of this application. In accordance with 37 CFR § 1.56, all such information is dutifully made of record. The foreseeable equivalents of any territory surrendered by amendment is limited to the territory taught by the information of record. No other territory afforded by the doctrine of equivalents is knowingly surrendered and everything else is unforeseeable at the time of this amendment by the Applicants and their attorneys.

Applicants respectfully submit that all of the grounds for rejection stated in the Examiner's Office Action have been overcome, and that all claims in the application are allowable. No new matter has been added. It is believed that the application is now in condition for allowance, which allowance is respectfully requested.

PLEASE CALL the undersigned if that would expedite the prosecution of this application.

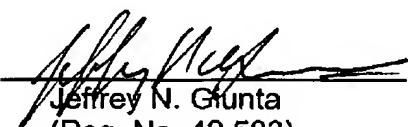
Respectfully Submitted,

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